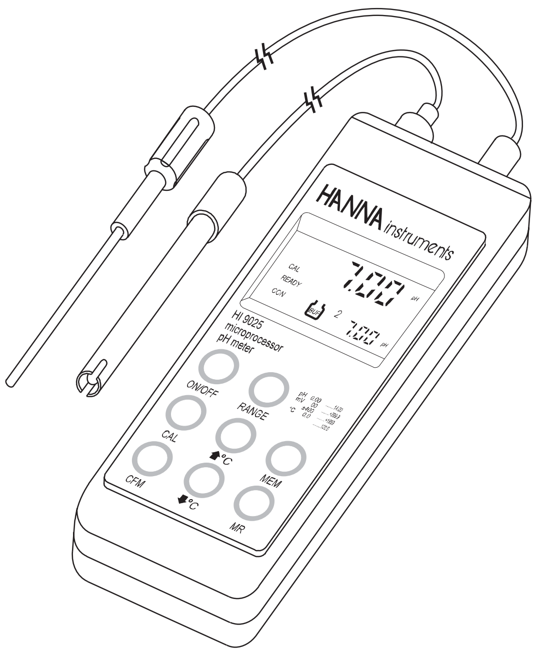
Instruction Manual

HI 9023C - HI 9023CN
HI 9024C - HI 9025C
HI 9110 - HI 9210
HI 9210N

Portable Waterproof pH Meters



Manufacturers since 1978

These Instruments are in Compliance with the CE Directives

Dear Customer,

Thank you for choosing a Hanna Product. Please read this instruction manual carefully before using the instrument. It will provide you with the necessary information for a correct use of the instrument, as well as a precise idea of its versatility. If you require further technical information, do not hesitate to e-mail us at tech@hannainst.com.

These instruments are in compliance with the CE directives.

TABLE OF CONTENTS

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any noticeable damage, notify your Dealer immediately.

Note: *Save all packing materials until you are sure that the instrument functions correctly. Any damaged or defective item must be returned in its original packing materials together with the supplied accessories.*

GENERAL DESCRIPTION

These waterproof Hanna instruments are heavy-duty pH meters designed to provide laboratory results and accuracy under harsh industrial conditions.

HI 9023C, pH/mV/°C meter *utilizes an advanced customized microprocessor. The meter has three memorized buffer values (4.01, 7.01 and 10.01) and automatic buffer recognition to avoid errors during calibration. There are no trimmers, making calibration an easy process, even for non-technical personnel. Temperature effects are automatically compensated for, or can be manually adjusted. With* ***HI 9023C*** *you can also measure ORP (Oxidation Reduction Potential) or Ion Specific. Millivolt measurements automatically switch from 0.1 to 1 mV resolution when the reading reaches 400mV.*

HI 9023C *is supplied with* **HI 1230B** *combination double-junction gel pH electrode,* **HI 7669/2W** *temperature probe, pH 4.01 and 7.01 (20 mL each) buffer solutions, sample vessel, 1.5V AA size batteries (4 each) and a rugged carrying case.*

HI 9023CN, pH/mV/°C meter *utilizes an advanced customized microprocessor. The meter has three memorized buffer values (4.01, 7.01 and 10.01) and automatic buffer recognition to avoid errors during calibration. Temperature effects are automatically compensated for.*

HI 9023CN *is supplied with* **HI 1217D** *4-in-1 amplified, gel pH/ C electrode, pH 4.01 and 7.01 (20 mL each) buffer solutions, sample vessel, 1.5V AA size batteries (4 each) and a rugged carrying case.*

HI 9024C *and* **HI 9025C** *are* **pH/°C meters** *with a built-in microprocessor. A large dual-level LCD displays the pH and temperature simultaneously. The display has graphic symbols to make the calibration procedure easy to follow. The meters have 5 memorized buffer values (4.01, 6.86, 7.01, 9.18 and 10.01), buffer recognition to avoid errors during calibration and automatic temperature compensation. You can use* **HI 9025C** *with ORP (Oxidation Reduction Potential) or Ion Specific Electrodes. Millivolt measurements automatically switch from 0.1 to 1 mV resolution when the reading reaches 400 mV. To insure trouble-free operation, the meter's circuitry comes with built-in protection against electromagnetic interference.*

HI 9024C *and* **HI 9025C** *are supplied with* **HI 1230B** *combination double-junction, gel pH electrode,* **HI 7669/2W** *temperature probe, pH 4.01 and 7.01 (20 mL each) buffer solutions, sample vessel, 1.5V AA size batteries (4 each) and a rugged carrying case.*

HI 9110 pH meter *has simple manual temperature compensation and calibration which make this meter easy to use in laboratory and field. The calibration trimmers are sealed behind a protective cover so that they cannot be accidentally moved or readjusted by unauthorized persons.*

HI 9110 *is supplied with* **FC 100B** *combination double-junction, refillable pH electrode, calibration screwdriver, 1.5V AA size batteries (4 each) and a soft carrying case.*

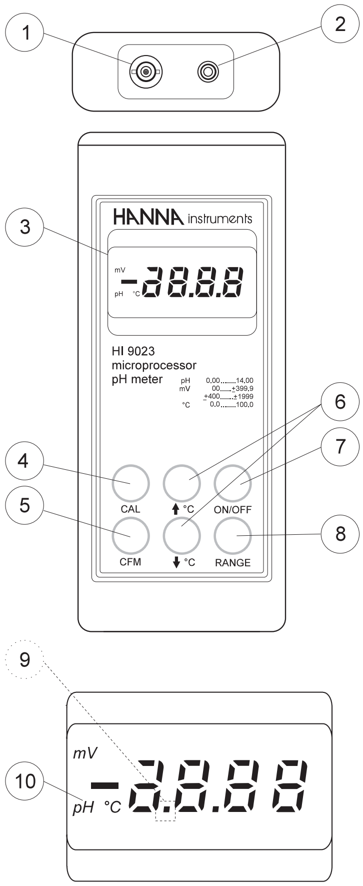
HI 9210 pH meter *has simple manual temperature compensation and calibration with only two buttons, making it simple to use for even non-technical personnel. The calibration trimmers are sealed behind a protective cover so that they cannot be accidentally moved or readjusted by unauthorized persons.*

HI 9210 *is supplied with* **HI 1230B** *combination double-junction, gel pH electrode, calibration screwdriver and 1.5V AA size batteries (4 each).*

HI 9210N pH/°C meter *measures both pH and temperature. It has only two buttons, making it simple to use for even non-technical personnel. The calibration trimmers are sealed behind a protective cover so that they cannot be accidentally moved or readjusted by unauthorized persons.*

HI 9210N *is supplied with* **HI 1217D** *4-in-1, gel, amplified pH/ C electrode, calibration screwdriver and 1.5V AA size batteries (4 each).*

FUNCTIONAL DESCRIPTION HI 9023C & HI 9023CN

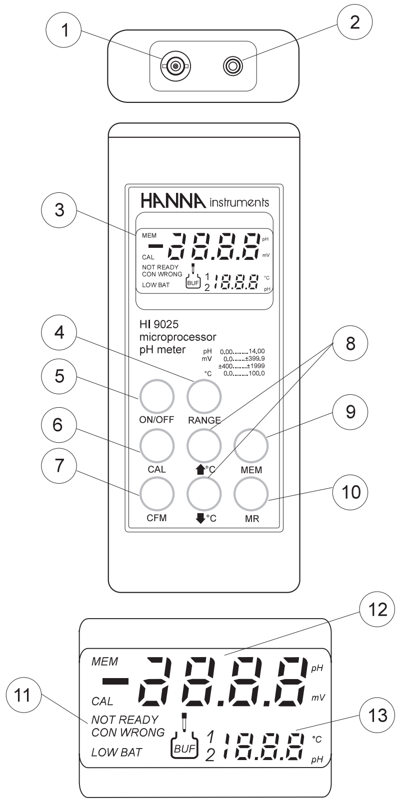


1) *Electrode connector (BNC for HI 9023C and DIN for HI 9023CN)*
2) *Temperature probe socket (HI 9023C only)*
3) *Liquid Crystal Display*
4) **CAL** *key to enter or exit calibration mode*
5) **CFM** *key to confirm calibration*
6) **↑°C** *and* **↓ C** *keys for manual temperature setting (HI 9023C only)*
7) **ON/OFF** *key to turn the instrument on or off*
8) **RANGE** *key to select pH, C or mV*
9) *Low battery indicator (additional decimal point)*
10) *Mode indicator*

SPECIFICATIONS HI 9023C & HI 9023CN

	HI 9023C	HI 9023CN
Range	*0.00 to 14.00 pH* *±399.9 mV (ISE); ±1999 mV (ORP)*	
	0.0 to 100.0 C	*0.0 to 70.0 C*
Resolution	*0.01 pH* *0.1 mV (ISE); 1 mV (ORP)* *0.1 C*	
Accuracy (@20°C/68°F)	*±0.01 pH* *±0.2 mV (ISE); ±1 mV (ORP)*	
	±0.4 C	*±0.5 C*
Typical EMC Deviation	*±0.02 pH* *±0.2 mV; ±1 mV*	
	±0.2 C	*±0.5 C*
Calibration	*Automatic with 3 memorized standard buffers (4.01, 7.01, 10.01)*	
Temperature Compensation	*Automatic or manual* *0 to 100 C (32-212 F)*	*Automatic* *0 to 70 C (32-158 F)*
Electrode	*HI1230B plastic body, combination pH, BNC 1 m cable* (included)	*HI1217D plastic body, 4-in-1 gel pH/ C, DIN 1 m cable* (included)
Temperature Probe	HI 7669/2W (incl.)	*not necessary*
Input Impedance	*10^{12} Ohm*	
Battery Type & Life	*4x1.5V, AA size (alkaline batteries)* *approx. 400 hours of continuous use* *auto-shut off after 10 minutes of non-use*	
Environment	*0 to 50 C (32 to 122 F); 100% RH*	
Dimensions	*196x80x60 mm (7.7x3.1x2.4") (meter)* *340x230x80 mm (13.8x9x3.1") (kit)*	
Weight	*425 g (15 oz.) (meter)* *1.3 Kg (3.0 lb.) (kit)*	

FUNCTIONAL DESCRIPTION HI 9024C & HI 9025C



1) *BNC electrode connector*
2) *Temperature probe socket*
3) *Liquid Cristal Display*
4) RANGE *key to select pH or mV (HI 9025C only)*
5) ON/OFF *key to turn the meter on or off*
6) CAL *key to enter or exit calibration mode*
7) CFM *key to confirm calibration*
8) ↑°C *and* ↓ C *keys for manual temperature setting, or selecting pH buffer value*
9) MEM *key to store pH value in memory*
10) MR *key to recall the stored value from memory*
11) *User-friendly graphic symbols*
12) *Primary display*
13) *Secondary display*

SPECIFICATIONS HI 9024C & HI 9025C

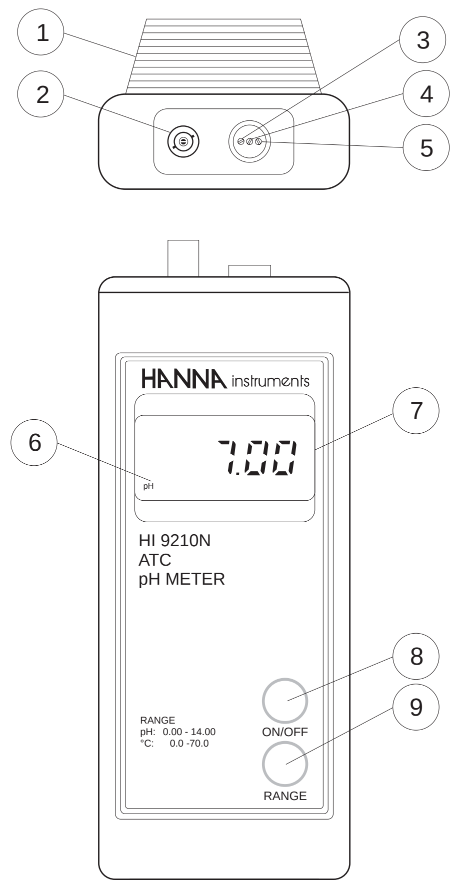
	HI 9024C	HI 9025C
Range	*0.00 to 14.00 pH; 0.0 to 100.0 C*	
	—	*0.0/±399.9 mV (ISE)*
	—	*±400/±1999 mV (ORP)*
Resolution	*0.01 pH; 0.1 C*	
	—	*0.1 mV (ISE)*
	—	*1 mV (ORP)*
Accuracy (@20°C/68°F)	*±0.01 pH; ±0.5 C*	
	—	*±0.2 mV (ISE)*
Typical EMC Deviation	*±0.01 pH; ±0.1 C*	
	—	*±0.3 mV (ISE)*
Calibration	*Automatic with 5 memorized standard buffers (4.01, 6.86, 7.01, 9.18, 10.01)*	
Offset Calibration	*±1 pH*	
Slope Calibration	*From 70 to 108%*	
Temperature Compensation	*Automatic or manual from 0 to 100 C (32 to 212 F)*	
Electrode	HI 1230B *pH electrode* (included)	
Temperature Probe	HI 7669/2W (included)	
Input Impedance	*10^{12} Ohm*	
Battery Type & Life	*4x1.5V, AA size (alkaline batteries) approx. 400 hours of continuous use auto-shut off after 10 minutes of non-use*	
Environment	*0 to 50 C (32 to 122 F); 100% RH*	
Dimensions	*meter: 196x80x60 mm (7.7x3.1x2.4") kit: 340x230x80 mm (13.8x9x3.1")*	
Weight	*meter: 425 g (15 oz.) kit: 1.3 Kg (3.0 lb.)*	

FUNCTIONAL DESCRIPTION HI 9110



1) *Battery cover*
2) *BNC electrode connector*
3) *Offset calibration trimmer*
4) *Slope calibration trimmer*
5) *Temperature setting trimmer*
6) *Mode indicator*
7) *Liquid Crystal Display*
8) **ON/OFF** *key to turn the meter on or off*
9) **pH/°C SET** *key to select pH measurement or for manual temperature setting*

FUNCTIONAL DESCRIPTION HI 9210 & HI 9210N



1) *Battery cover*
2) *Electrode connector (BNC for HI 9210 and DIN for HI 9210N)*
3) *Offset calibration trimmer*
4) *Slope calibration trimmer*
5) *Temperature setting trimmer (HI 9210) or Temperature Calibration (HI 9210N)*
6) *Mode indicator*
7) *Liquid Crystal Display*
8) **ON/OFF** *key to turn the meter on or off*
9) **RANGE** *key to visualize the temperature (HI 9210N) or for manual temperature setting (HI 9210)*

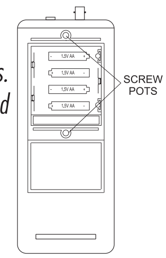
SPECIFICATIONS HI 9110, HI 9210 & HI 9210N

		HI 9110	HI 9210	HI 9210N
Range	pH	*0.00 to 14.00 pH*		
	°C	—		*0.0 to 70.0 C*
Resolution	pH	*0.01 pH*		
	°C	—		*0.1 C*
Accuracy (@20°C/68°F)	pH	*±0.02 pH*		
	°C	—		*±0.5 C*
Typical EMC Deviation	pH	*±0.05 pH*		*±0.02 pH*
	°C	—		*±0.5 C*
Calibration		*Manual 2 points through trimmers*		
Offset Calibration		*±1 pH*		
Slope Calibration		*From 85 to 105% of nominal value*		
Temperature Compensation		*Manual 0 to 100 C (32 to 212 F)*		*Auto 0 to 70 C (32 to 158 F)*
Electrode		FC 100B *pH* (incl.)	HI 1230B *pH* (incl.)	HI 1217D *pH/ C* (incl.)
Input Impedance		*10^{12} Ohm*		
Battery Type Life		*4x1.5 volt, AA size (alkaline batteries); 2000 hours of continuous use*		
Environment		*0 to 50 C (32 to 122 F); 100% RH*		
Dimensions		*196 x 80 x 60 mm (7.7 x 3.1 x 2.4")*		
Weight		*320 g (11.3 oz.)*		

OPERATIONAL GUIDE

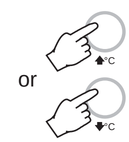
INITIAL PREPARATION

Each meter is supplied complete with batteries. Remove the back cover, unwrap the batteries and install them while paying attention to polarity.



HI 9023C, HI 9024C, HI 9025C:

To prepare the instrument for use connect the pH electrode and the temperature probe to the BNC and temperature sockets on the top of the instrument. The temperature probe can be used independently to take temperature measurements, or it can be used in conjunction with the pH electrode to utilize the meter's ATC capability. If the probe is disconnected, temperature can also be set manually with the UP and DOWN keys. To switch the instrument on, press and hold the ON/OFF key for a fraction of a second. The meter has a built-in protection against electro-magnetic interference and the delayed response of the keys assures that the commands are not mistaken for stray signals.





HI 9110 and HI 9210:

Connect the pH electrode to the BNC connector on the top of the instrument and press the ON/OFF key.

HI 9210N and HI 9023CN:

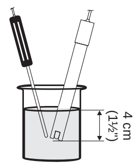


Connect the pH/ C electrode to the DIN connector on the top of the instrument and press the ON/OFF key.



pH MEASUREMENTS

To take a pH measurement remove the electrode protective cap and simply submerge the tip (4cm/1½") of the electrode and the temperature probe (wherever applicable) into the sample to be tested.



Turn the instrument ON and if necessary, press RANGE until the display changes to the pH mode.





Allow for the electrode to adjust to the solution and stabilize.

In order to take more accurate pH measurements, make sure that the instrument is calibrated (see page 16).

It is recommended that the electrode is always kept wet and rinsed thoroughly with the sample to be measured before use.

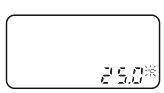
The pH reading is directly affected by temperature. In order for the meter to measure the pH accurately, temperature must be taken in consideration. If the sample temperature is quite different from the temperature at which the pH electrode was kept, allow a few minutes for a perfect thermal equilibrium between them.

HI 9023C, HI 9024C and HI 9025C:

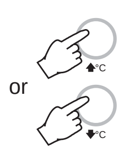
To use the meter's Automatic Temperature Compensation feature, submerge the temperature probe into the sample as close to the electrode as possible and wait for a couple of minutes. If you know the temperature of the sample to be tested you can manually compensate for it.

If manual temperature compensation is desired the temperature probe must be disconnected from the instrument.

The display will show the default temperature of 25°C or the last recorded temperature reading with the "°C" indicator blinking.



The temperature can now be adjusted with the UP and DOWN keys.



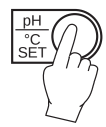
HI 9023C, HI 9023CN and HI 9210N

To use the meter's Automatic Temperature Compensation feature, simply submerge the pH/°C electrode into the sample and wait for a couple of minutes. The pH electrode also houses the temperature sensor which will measure and adjust for the temperature effect automatically.

HI 9110, HI 9210:

To use the meter's Manual Temperature Compensation feature:

Press the pH/°C key of HI 9110 *or the RANGE key of* HI 9210 *to select the manual temperature mode.*

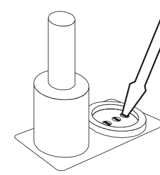




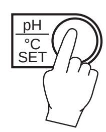
Remove the protective cap on top of the meter to access the trimmers. Measure the temperature of the buffer with a Checktemp or an accurate thermometer.



Using the calibration screwdriver, turn the temperature trimmer (#5 pages 9-10) to display the measured temperature value.



Press the pH/°C key of HI 9110 *or the RANGE key of* HI 9210 *to return to the pH measurement mode.*





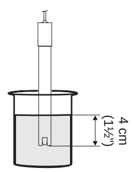
When finished, switch the instrument off and rinse the electrode with clean water. Pour a few drops of HI 70300 storage solution, or in its absence, pH 7 or pH 4 buffers in the protective cap and replace it before storing away the electrode.

ORP MEASUREMENTS (HI 9023C AND HI 9025C)

To enter the "mV" mode (ORP or ISE), turn the instrument ON and press the RANGE key until the display changes to mV.



To measure the mV of a solution simply submerge the ORP or ISE electrode tip (4cm/ 1½") into the sample to be tested. Allow a few minutes for the readings to stabilize. See also "Taking REDOX Measurements" section at page 29.



TEMPERATURE MEASUREMENTS (HI 9023C, HI 9023CN, HI 9024C, HI 9025C AND HI 9210N):

Taking a temperature measurement is very easy. Turn the instrument ON and press the RANGE key to enter temperature mode.



For **HI 9023C**, **HI 9024C** *and* **HI 9025C**, *dip the liquid/general purpose temperature probe* **HI 7669/2W** *into the sample. For* **HI 9023CN** *and* **HI 9210N**, *simply dip the pH/°C electrode which contains the temperature sensor. Then allow a couple of minutes for the reading to stabilize.*

Note: *You can also calibrate the offset point of the* **HI 9210N** *temperature sensor, if needed. For this purpose, immerse the pH/°C electrode in a solution at a known temperature. Then turn the #5 trimmer (see page 10) until the temperature displayed on the LCD is that of the solution.*

pH CALIBRATION

It is recommended to calibrate the instrument frequently, especially if high accuracy is required.

The instrument should be recalibrated for pH:

a) Whenever the pH electrode or temperature probe is replaced.

b) At least once a month.

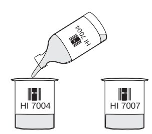
c) After testing aggressive chemicals.

d) Whenever the batteries have been replaced.

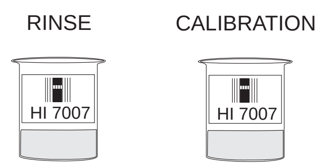
e) If greater accuracy is required.

PREPARATION

Pour small quantities of pH 7.01 and pH 4.01 solution into two clean beakers.



For accurate calibration use two beakers for each buffer solution, the first one for rinsing the electrode and the second one for calibration. This way contamination of buffer is minimized.



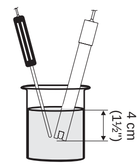
To obtain accurate readings, use pH 7.01 and pH 4.01 buffers if you are going to measure acidic samples, or pH 7.01 and pH 10.01 for alkaline measurements.

PROCEDURE FOR HI 9023C AND HI 9023CN:

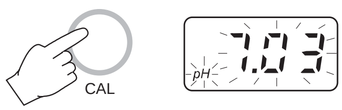
- *Make sure that the meter is in the pH mode.*
- *Remove the protective cap from the electrode, rinse it with some pH 7.01 solution, then immerse the pH electrode and temperature probe (**HI 9023C**) or the pH/°C electrode (**HI 9023CN**) into pH 7.01 buffer solution and stir gently and wait for the reading to stabilize.*



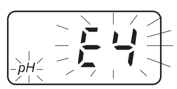
Note: *The electrode should be submerged approximately 4 cm (1½") into the solution. With the temperature probe located as close to it as possible (**HI 9023C**).*



- *Press the CAL key. The temperature compensated pH value will blink on the display. For example, if the temperature is 25°C the reading will be pH 7.01. If the temperature is 20°C the reading*

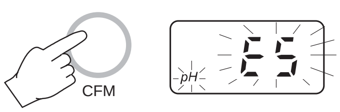


will be 7.03. The pH/temperature conversion chart is on page 24.

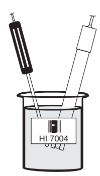


Note: *If "E4" flashes, the buffer solution is wrong or the probe is defective (see page 25 for troubleshooting).*

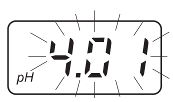
- *Wait for the "pH" symbol to stop flashing and press the CFM*



key. The symbol "E5" will flash to indicate that the electrode is still in the pH 7.01 buffer.



- *Rinse the pH electrode (and the temperature probe) with distilled water first and with the pH 4.01 (or 10.01) buffer after.*
- *Dip the electrode (and the temperature probe) into the pH 4.01 (or 10.01) buffer solution. Stir gently and wait for the reading to stabilize.*
- *The "E5" symbol should disappear and the temperature compensated value will blink on the display. For example, if you are using pH 4.01 as the buffer, the reading will be 4.01 at 25°C.*



- *When the "pH" symbol stops flashing, press CFM to confirm the calibration.*



The instrument is now calibrated and will remain calibrated even

when it is turned off.

Note: *The meter will lose the calibration if the batteries are removed.*

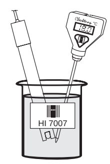


<u>**HI 9023C only:**</u>

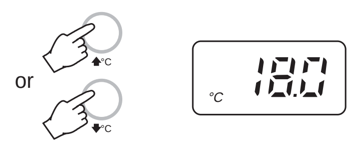
To calibrate with **manual temperature compensation***, follow this procedure:*



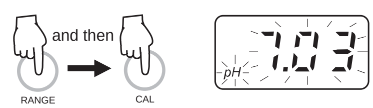
- *Disconnect the temperature probe and switch the instrument ON.*
- *Press RANGE to select the temperature mode.*



- *Place the pH electrode into the 7.01 buffer stir gently and wait for the LCD to stabilize.*

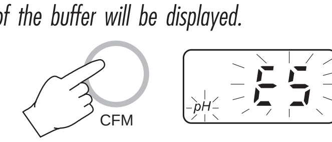


- *Record the buffer temperature by using a Checktemp C or an*

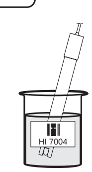


accurate thermometer (e.g. 18°C).

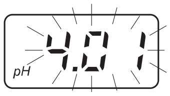
- *Press the UP and DOWN to adjust the temperature accordingly.*
- *Press RANGE to display pH and then press the CAL key. The value of the buffer will be displayed.*



- *Wait for the "pH" symbol to stop flashing.*
- *Press CFM. The "E5" symbol will flash to indicate that the electrode is still in the 7.01 solution.*



- *Rinse the electrode with clean or distilled water first and then with pH 4.01 (or 10.01) buffer. Dip the electrode into the pH*





4.01 (or 10.01) solution and stir gently.

- *Wait for the "pH" symbol to stop flashing. Press CFM to confirm the calibration.*

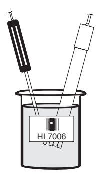
PROCEDURE FOR HI 9024C AND HI 9025C:

In order to calibrate **HI 9024C** *and* **HI 9025C**, *there is a choice of 5 memorized buffers: 4.01, 6.86, 7.01, 9.18 and 10.01 pH.*

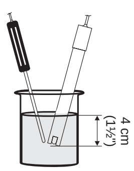
- *Make sure that the meter is in the pH mode.*
- *Remove the protective cap and rinse the electrode with some of the buffer calibration solution that you are going to use first.*

ONE-POINT CALIBRATION:

It is always recommended to perform a two-point calibration for optimum accuracy. In case of necessity, it is possible to carry out only a one-point calibration with the instruments. The offset buffers, that is the Standard 7.01 or the NIST 6.86 are the most appropriate for this purpose even though both meters can be calibrated with any of the 5 memorized calibration solutions.

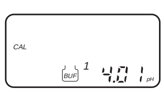


- *Immerse the pH electrode into a pH buffer solution (e.g. pH 6.86) and stir gently.*

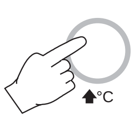


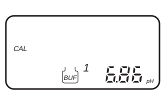
Note: *The electrode should be submerged approximately 4 cm (1½") into the solution. With the temperature probe located*





as close to it as possible.





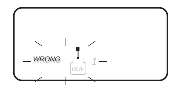
- *Once the electrode is submerged in the buffer solution, the LCD will notify the user if the reading is not stable by an intermittent "NOT READY". Only when the reading is stable, will it change to a blinking "READY" and "CON".*

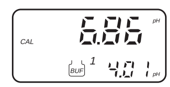




- *Press the CFM key to confirm the calibration. If the reading is not close to the selected buffer, "WRONG 1" and "WRONG" will blink alternatively. If the reading is close to the selected buffer, the meter stores the reading (and adjusts the offset point). The buffer value is then displayed on the primary LCD and the secondary LCD will display another buffer value (e.g."4.01").*







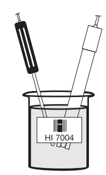
- *Press the CAL key and the calibration process is ended with only the offset of the meter calibrated. For best accuracy however, do not press CAL and proceed with a two-point calibration.*



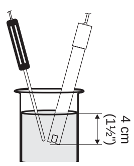
TWO-POINT CALIBRATION

After calibrating at 6.86 or 7.01 pH (see above), for the second buffer use pH 4.01 if you are going to measure acidic samples, and pH 9.18 or pH 10.01 if you are measuring alkaline solutions.

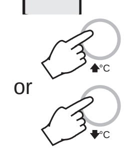
- *Proceed as described in "One-point calibration above but do not end the calibration by pressing CAL.*
- *After the first calibration point is confirmed, immerse the pH electrode into the second buffer solution (pH 4.01, 9.18 or 10.01) and stir gently.*



Note: *The electrode should be submerged approximately 4 cm (1½") into the solution with the temperature probe located as close to it as possible.*



- *Select the second buffer value on the secondary display by pressing the* ↑°C *or* ↓ C *key.*

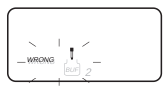


Note: *The electrode should be submerged approximately 4 cm (1½") into the solution with the temperature probe located as close to it as possible.*



- *Select the second buffer value on the secondary display by*





pressing the ↑°C or ↓°C key.

- *When the "READY" and "CON" symbols blink on the display, the reading is stable and the calibration can be confirmed.*
- *Press the CFM key. If the reading is not close to the selected buffer solution, "WRONG BUF 2" and "WRONG" will blink alternatively. If the reading is close to the selected buffer, the slope and the offset are calibrated. The values will be stored in memory and the meter will return to the operating mode.*

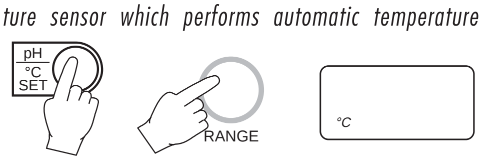
Note: *The meter will automatically skip the buffer that was used for the first calibration to avoid erroneous calibration. At least 1 full pH unit is required between the two buffers used for the offset and slope calibration. As a result, once calibrated at either pH 6.86 or 7.01, the microprocessor will automatically ignore the other one for the second point calibration. It will do likewise for pH 9.18 and 10.01*

Note: *During calibration, the secondary LCD displays the selected buffer value. With HI 9025C, press the RANGE key to display the buffer temperature during calibration.*

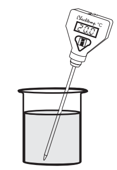
PROCEDURE FOR HI 9110, HI 9210 & HI 9210N:

Manual Temperature Compensation

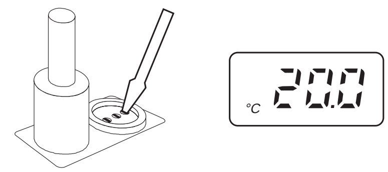
Note: *The pH/°C electrode of* **HI 9210N** *incorporates a temperature sensor which performs automatic temperature*



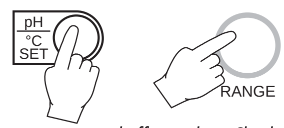
compensation. Consequently, the following 5 paragraphs are irrelevant to **HI 9210N** *and you can just proceed with pH calibration below.*



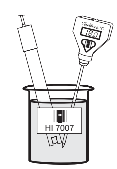
- *Press pH/°C SET key for* **HI 9110** *or the RANGE key for* **HI 9210** *to select the manual temperature setting. The "°C" symbol will be displayed to indicate the temperature setting mode.*



- *Remove the protective cap on the top of the meter to have access to the calibration trimmers.*

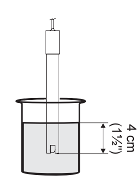


- *Record the temperature of the buffer with a Checktemp C or an accurate thermometer (e.g.20°C).*
- *Using the screwdriver, turn the temperature trimmer (# 5 pages 9-10) to display the recorded temperature value.*
- *Press the pH/°C SET key for* **HI 9110** *or the RANGE key for* **HI 9210** *to read pH.*



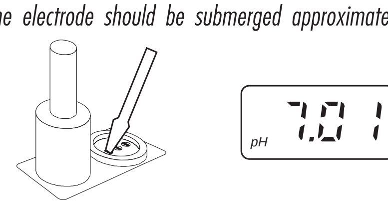
pH Calibration

All three meters provide for manual pH calibration. As a result, you can perform one or two point calibration at a buffer of your choice. The instructions below explain a typical calibration procedure at pH 7 and then 4 or 10.

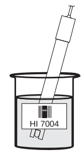


- *Remove the protective cap from the electrode, rinse it with some pH 7.01 solution, then dip in pH 7.01 buffer. Stir briefly and wait for one minute for the reading to stabilize.*

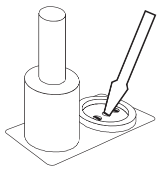
Note: *The electrode should be submerged approximately 4 cm*



(1½") into the solution. For HI 9110 *and* HI 9210*, place the thermometer close to the pH electrode.*



- *Adjust the OFFSET trimmer (#3 pages 9-10) until the LCD shows the pH value at the buffer temperature (see page 24 for pH values at various temperatures). With* HI 9210N*, press RANGE to read the buffer temperature.*





- *Rinse first with clean or distilled water and then with a small amount of the next buffer (2nd calibration point). Dip the electrode into pH 4.01 (or 10.01) buffer, stir gently and wait until the display has stabilized.*
- *Adjust the SLOPE trimmer (#4 pages 9-10) until the LCD displays the pH value at the second buffer temperature (see page 24).*
- *pH calibration is now complete. Once the calibration process is complete, replace the trimmer cover and tighten it to ensure a proper seal against water and humidity ingress.*

pH VALUES AT VARIOUS TEMPERATURES

Temperature has an effect on pH. The calibration buffer solutions are affected by temperature changes to a lesser degree than normal solutions.

For manual temperature calibration (standard with HI 9110 *and* HI 9210 *or optional with* HI 9023C*,* HI 9024C *and* HI 9025C*) please refer to the following chart.*

TEMP		pH VALUES				
°C	°F	4.01	6.86	7.01	9.18	10.01
0	32	4.01	6.98	7.13	9.46	10.32
5	41	4.00	6.95	7.10	9.39	10.24
10	50	4.00	6.92	7.07	9.33	10.18
15	59	4.00	6.90	7.04	9.27	10.12
20	68	4.00	6.88	7.03	9.22	10.06
25	77	4.01	6.86	7.01	9.18	10.01
30	86	4.02	6.85	7.00	9.14	9.96
35	95	4.03	6.84	6.99	9.10	9.92
40	104	4.04	6.84	6.98	9.07	9.88
45	113	4.05	6.83	6.98	9.04	9.85
50	122	4.06	6.83	6.98	9.01	9.82
55	131	4.07	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.85	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75

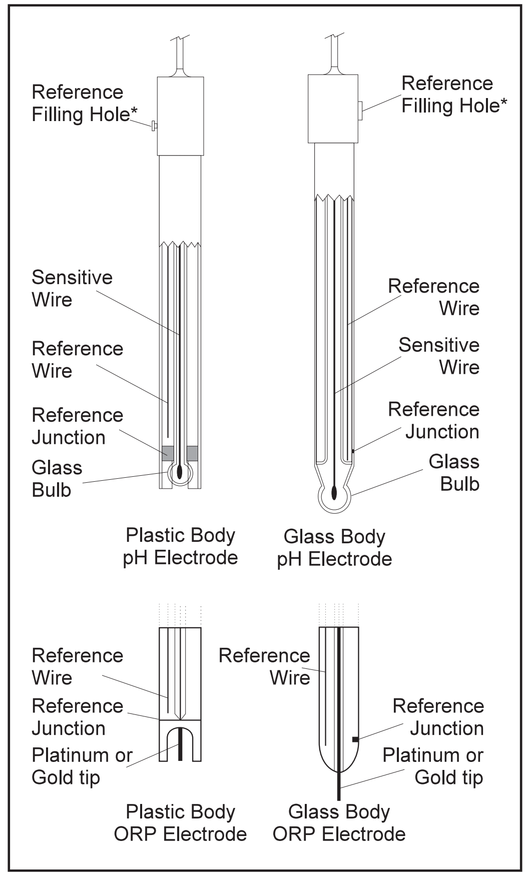
For instance, if the buffer temperature is 25 C, the display should show pH 4.01, 7.01 or 10.01 at pH 4, 7 or 10 buffers, respectively.

At 20 C, the display should show pH 4.00, 7.03 or 10.06. The meter reading at 50 C will then be 4.06, 6.98 or 9.82.

TROUBLESHOOTING GUIDE

Symptoms	Problem	Solution
The meter is slow in responding or gives faulty readings	*The electrode is not working or the reference junction is clogged*	*Leave the electrode in a storage solution after cleaning the junction. If problem persists, replace the electrode*
The meter does not accept the 2nd buffer solution for calibration	*Out of order pH electrode*	*Follow the cleaning procedure. If this doesn't work replace the electrode*
The reading drifts	*Out of order electrode*	*Replace the pH electrode*
Display shows: "E1" or - - - - pH	*Out of range pH scale*	*a) Recalibrate b) Make sure the pH sample is in the 0 to 14 range c) Check the electrolyte level and the general state of the pH electrode*
Display shows: "E2" or - - - - pH - - - °C	*Out of range temperature scale*	*Make sure the temperature is in the 0 to 100 C (or 70 C) range and the probe is plugged in*
Display shows: "E3" or - - - - mV	*Out of range mV scale*	*Electrode not connected*
Display shows: "E4" or "WRONG BUF 1" and/or "WRONG "	*Erroneous buffer solution used for offset calibration*	*Make sure the buffer setting is correct and the solution is fresh. Replace the buffer if necessary*
	Out of order electrode	*Replace the pH electrode*
Display shows: "E5" or "WRONG BUF 2" and/or "WRONG "	*Erroneous buffer solution used for slope calibration*	*Make sure the buffer setting is correct and the solution is fresh. Replace the buffer if necessary*
	Out of order electrode	*Replace the pH electrode*
The meter does not work with the temperature probe	*Out of order temperature probe*	*Replace the probe*
The meter fails to calibrate or gives faulty readings	*Out of order pH electrode*	*Replace the electrode*
Display acts erratically	*The microprocessor has been electronically disturbed*	*Remove one of the batteries for one minute to reset the microprocessor*

ELECTRODE CONDITIONING & MAINTENANCE



** Not present in gel electrodes.*

PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT. This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may form inside the glass bulb affecting proper functioning of the electrode. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb and/or junction is dry, soak the electrode in **HI 70300** *or* **HI 80300** *Storage Solution for at least one hour.*

For refillable electrodes:

If the filling solution (electrolyte) is more than 2½ cm (1") below the fill hole, add HI 7082 *or* HI 8082 *3.5M KCl Electrolyte Solution for double junction or* HI 7071 *or* HI 8071 *3.5M KCl+AgCl Electrolyte Solution for single junction electrodes.*

For a faster response, unscrew the fill hole screw during measurements.

For AmpHel®electrodes:

If the electrode does not respond to pH changes, the battery is run down and the electrode should be replaced.

MEASUREMENT

Rinse the electrode tip with distilled water. Immerse the tip (bottom 4 cm / 1½") in the sample and stir gently for a few seconds.

For a faster response and to avoid cross contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested, before taking measurements.

STORAGE

To minimize clogging and assure a quick response time, the glass bulb and the junction should be kept moist and not allowed to dry out.

Replace the solution in the protective cap with a few drops of HI 70300 *or* HI 80300 *Storage Solution or, in its absence, Filling Solution (*HI 7071 *or* HI 8071 *for single junction or* HI 7082 *or* HI 8082 *for double junction electrodes). Follow the Preparation Procedure above before taking measurements.*

Note: *NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.*

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for connection to the meter must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

For refillable electrodes:

*Refill the reference chamber with fresh electrolyte (*HI 7071 *or* HI 8071 *for single junction or* HI 7082 *or* HI 8082 *for double junction electrodes). Allow the electrode to stand upright for 1 hour.*

Follow the Storage Procedure above.

CLEANING PROCEDURE

General — *Soak in Hanna* HI 7061 *or* HI 8061 *General Cleaning Solution for approximately ½ hour.*

Removal of films, dirt or deposits on the membrane/junction:

- *Protein* — *Soak in Hanna* HI 7073 *or* HI 8073 *Protein Cleaning Solution for 15 minutes.*
- *Inorganic* — *Soak in Hanna* HI 7074 *or* HI 8074 *Inorganic Cleaning Solution for 15 minutes.*
- *Oil/grease* — *Rinse with Hanna* HI 7077 *or* HI 8077 *Oil and Fat Cleaning Solution.*

IMPORTANT: *After performing any of the cleaning procedures rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (not necessary for gel-filled electrodes) and soak the electrode in* HI 70300 *or* HI 80300 *Storage Solution for at least 1 hour before taking measurements.*

TROUBLESHOOTING

Evaluate your electrode performance based on the following.

- Noise *(Readings fluctuate up and down) could be due to:*
  - Clogged/Dirty Junction: *Refer to the Cleaning Procedure above.*
  - Loss of shielding *due to low electrolyte level (in refillable electrodes only): refill with fresh* HI 7071 *or* HI 8071 *for single junction or* HI 7082 *or* HI 8082 *for double junction electrodes.*
- Dry Membrane/Junction: *Soak in* HI 70300 *or* HI 80300 *Storage Solution for at least 1 hour.*
- Drifting: *Soak the electrode tip in warm (approx. 50-60□C) Hanna* HI 7082 *or* HI 8082 *Solutions for one hour and rinse the tip with distilled water. Refill with fresh* HI 7071 *or* HI 8071 *for single junction electrodes and* HI 7082 *or* HI 8082 *for double junction electrodes (refillable electrodes only).*
- Low Slope: *Refer to the cleaning procedure above.*
- No Slope: *Check the electrode for cracks in glass stem or bulb and replace the electrode.*
- Slow Response/Excessive Drift: *Soak the tip in* HI 7061 *or* HI 8061 *Solutions for 30 minutes, rinse thoroughly in distilled water and then follow the Cleaning Procedure above.*

TAKING REDOX MEASUREMENTS (HI 9023C & HI 9025C only)

HI 9023C *and* HI 9025C *have the capability to take ORP measurements. An optional ORP electrode must be used to perform these measurements.*

Oxidation-Reduction Potential (REDOX) measurements provide the quantification of the oxidizing or reducing power of the sample tested.

To correctly perform a redox measurement, the surface of the ORP electrode must be clean and smooth.

In order to improve performance and obtain a faster response time, precondition your ORP electrode with reducing or oxidizing solutions.

Generally speaking, if the ORP mV reading corresponding to the pH value of the solution is higher than the values in the table below, an oxidizing pretreatment is necessary; otherwise a reducing pretreatment is necessary:

pH	mV	pH	mV	pH	mV	pH	mV	pH	mV
0	990	1	920	2	860	3	800	4	740
5	680	6	640	7	580	8	520	9	460
10	400	11	340	12	280	13	220	14	160

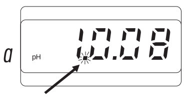
Reducing pretreatment: immerse the electrode for a few minutes in HI 7091.

Oxidizing pretreatment: immerse the electrode for a few minutes in HI 7092.

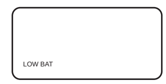
When not in use, the tip of the electrode should be kept moist and safe from any mechanical stress which might cause damage to the glass/platinum junction.

BATTERY REPLACEMENT & AUTO-OFF

If the batteries become weak:



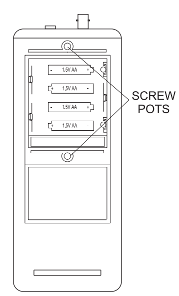
- HI 9023C and HI 9023CN *will display a blinking additional decimal point.*



- HI 9024C and HI 9025C *will display "LOW BAT".*



- HI 9110, HI 9210 and HI 9210N *will display a "V" on the LCD. Note:* ***HI 9110***, ***HI 9210*** *and* ***HI 9210N*** *are supplied with the advanced "BEPS", Battery Error Preventive System, that detects a low voltage condition in the battery. The "V" symbol is to alert the user that the display will be shut-off after about 5 hours of use. After that, the meter shuts down the display, preventing the taking of erroneous measurements due to low voltage.*



Battery replacement must only take place in a non hazardous area using the battery types specified in this instruction manual. To replace rundown batteries, remove the two screws on the rear cover of the instrument and replace all four 1.5V AA batteries with new ones, while paying attention to the correct polarity. Replace the cover and tighten the two screws. The meter is reset any time the batteries are removed. In case of any functional problems, reset the meter by removing and reinstalling the batteries.

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI 70004P *pH 4.01 Buffer Sachets, 20mL, 25 pcs*
HI 70007P *pH 7.01 Buffer Sachets, 20mL, 25 pcs*
HI 70010P *pH 10.01 Buffer Sachets, 20mL, 25 pcs*
HI 7004L *pH 4.01 Buffer Solution, 460 mL*
HI 7006L *pH 6.86 Buffer Solution, 460 mL*
HI 7007L *pH 7.01 Buffer Solution, 460 mL*
HI 7009L *pH 9.18 Buffer Solution, 460 mL*
HI 7010L *pH 10.01 Buffer Sol., 460 mL*

pH CALIBRATION SOLUTIONS IN FDA APPROVED BOTTLE

HI 8004L *pH 4.01 Buffer Solution, 460 mL*
HI 8006L *pH 6.86 Buffer Solution, 460 mL*
HI 8007L *pH 7.01 Buffer Solution, 460 mL*
HI 8009L *pH 9.18 Buffer Solution, 460 mL*
HI 8010L *pH 10.01 Buffer Solution, 460 mL*

ELECTRODE STORAGE SOLUTION

HI 70300L *Storage Solution, 460 mL*
HI 80300L *Storage Solution in a FDA approved bottle, 460 mL*

ELECTRODE CLEANING SOLUTIONS

HI 70000P *Electrode Rinse Sachets, 20 mL, 25 pcs*
HI 7061L *General Cleaning Sol., 460 mL*
HI 7073L *Protein Cleaning Sol., 460mL*
HI 7074L *Inorganic Cleaning Sol., 460mL*
HI 7077L *Oil & Fat Cleaning Sol.,460 mL*

ELECTRODE CLEANING SOLUTIONS IN FDA APPROVED BOTTLES

HI 8061L *General Cleaning Solution, 460 mL*
HI 8073L *Protein Cleaning Solution, 230 mL*
HI 8077L *Oil & Fat Cleaning Solution, 460mL*

REFILL ELECTROLYTE SOLUTIONS

HI 7071 *3.5M KCl + AgCl Electrolyte, 4x50mL, for single junction electrodes*
HI 7072 *1M KNO_3 Electrolyte, 4x50 mL*
HI 7082 *3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes*

REFILL ELECTROLYTE SOLUTIONS IN FDA APPROVED BOTTLES

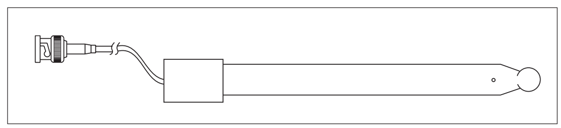
HI 8071 *3.5M KCl + AgCl Electrolyte, 4x50mL, for single junction electrodes*
HI 8072 *1M KNO_3 Electrolyte, 4x50 mL*
HI 8082 *3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes*

ORP PRETREATMENT SOLUTIONS

HI 7091L *Reducing Pretreatment Solution, 460 mL*
HI 7092L *Oxidizing Pretreatment Solution, 460 mL*

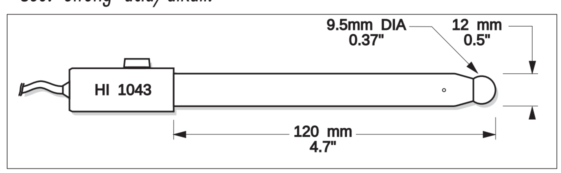
pH & ORP ELECTRODES

All electrodes part numbers ending in B are supplied with a BNC connector and 1 m (3.3') cable, as shown below:



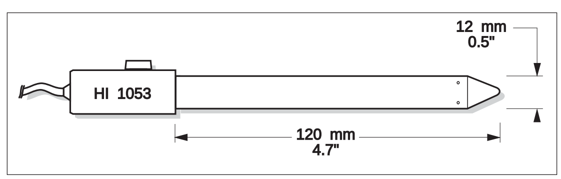
HI 1043B

Glass-body, double junction, refillable, combination **pH** *electrode. Use: strong acid/alkali.*



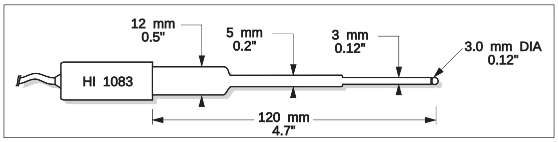
HI 1053B

Glass-body, triple ceramic, conic shape, refillable, combination **pH** *electrode. Use: emulsions.*



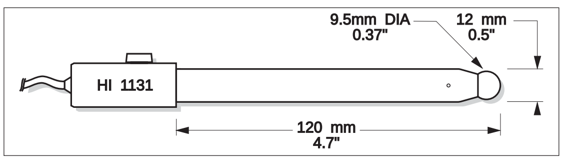
HI 1083B

Glass-body, micro, Viscolene, non-refillable, combination pH *electrode. Use: biotechnology, micro titration.*



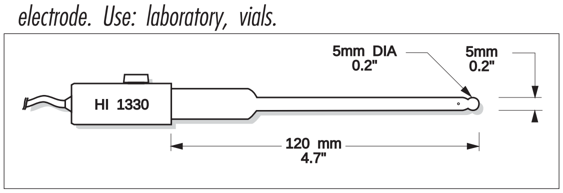
HI 1131B

Glass-body, single junction, refillable, combination pH *electrode. Use: general purpose.*



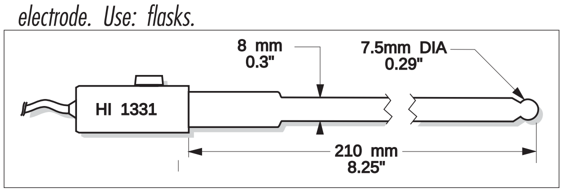
HI 1330B

Glass-body, semimicro, single junction, refillable, combination pH *electrode. Use: laboratory, vials.*



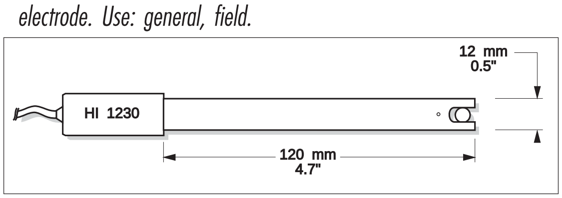
HI 1331B

Glass-body, semimicro, single junction, refillable, combination pH *electrode. Use: flasks.*



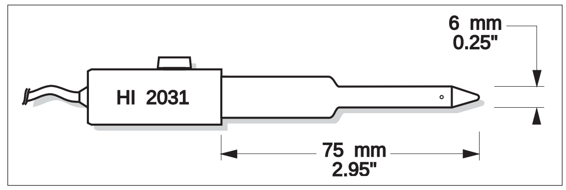
HI 1230B

Plastic-body (Ultem®), double junction, gel-filled, combination pH *electrode. Use: general, field.*



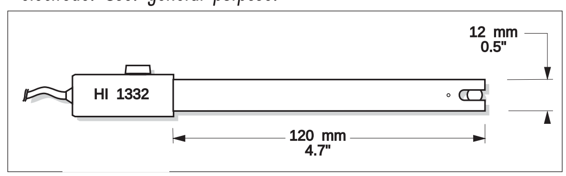
HI 2031B

Glass-body, semimicro, conic, refillable, combination pH *electrode. Use: semisolid products.*



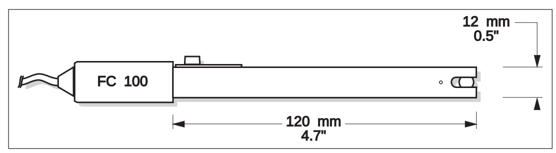
HI 1332B

Plastic-body (Ultem®), double junction, refillable, combination pH *electrode. Use: general purpose.*



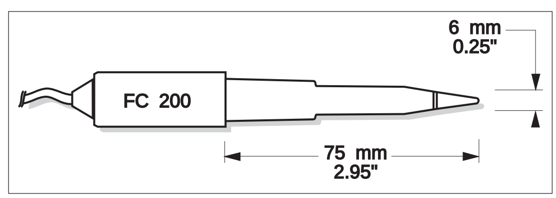
FC 100B

Plastic-body (Kynar®), double junction, refillable, combination pH *electrode. Use: general purpose for food industry.*



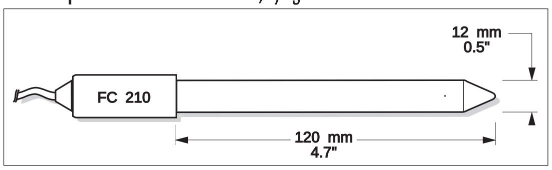
FC 200B

Plastic-body (Kynar®), open junction, conic, Viscolene, non-refillable, combination pH *electrode. Use: meat & cheese.*



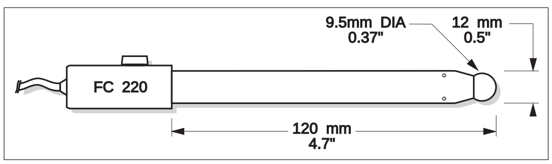
FC 210B

Glass-body, double junction, conic, Viscolene, non-refillable, combination **pH** *electrode. Use: milk, yogurt.*



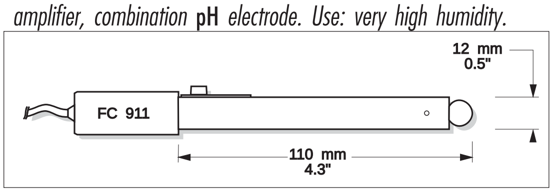
FC 220B

Glass-body, triple-ceramic, single junction, refillable, combination **pH** *electrode. Use: food processing.*



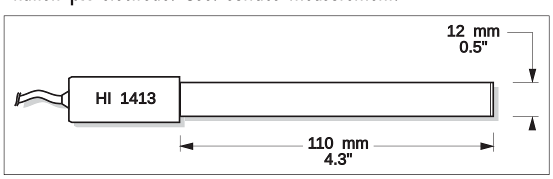
FC 911B

Plastic-body (Kynar®), double junction, refillable with built-in amplifier, combination **pH** *electrode. Use: very high humidity.*



HI 1413B

Glass-body, single junction, flat tip, Viscolene, non-refillable, combination **pH** *electrode. Use: surface measurement.*

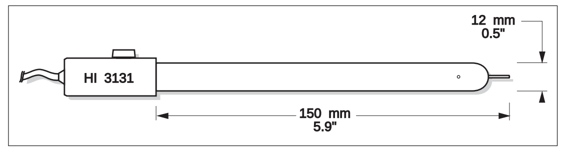


Ultem® is registered Trademark of "General Electrics Co."
Kynar® is registered Trademark of "Pennwalt Corp."

<u>ORP electrodes:</u>

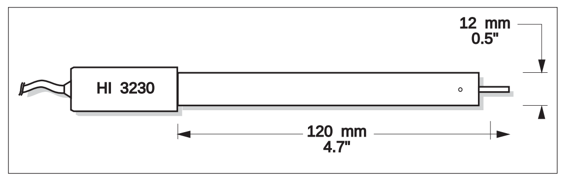
HI 3131B

Glass-body, refillable, combination platinum **ORP** *electrode. Use: titration.*



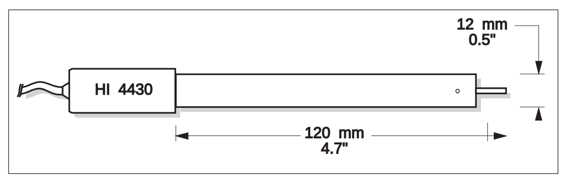
HI 3230B

Plastic-body (Ultem®), gel-filled, combination platinum **ORP** *electrode. Use: general purpose.*



HI 4430B

Plastic-body (Ultem®), gel-filled, combination gold **ORP** *electrode. Use: general purpose.*



Consult the Hanna General Catalog for an extensive selection of electrodes.

<u>OTHER ACCESSORIES</u>

ChecktempC *Pocket-size thermometer (range -50.0 to 150.0°C)*
HI 76405 *Electrode holder*
HI 7669/2W *Temperature probe with 1 m (3.3') screened cable (not* **HI 9110**, **HI 9210**, **HI 9210N** *and* **HI 9023CN***)*
HI 8427 *pH and ORP electrode simulator with 1 m (3.3') coaxial cable ending in female BNC connectors*
HI 931001 *pH and ORP electrode simulator with LCD and 1 m (3.3') coaxial cable ending in female BNC connectors*
HI 721317 *Rugged carrying case*

ELECTRODE APPLICATION REFERENCE GUIDE

Application	Electrodes*
1. Aquarium	HI 1332B
2. Bath-water	HI 1130B
3. Beer	HI 1131B
4. Bread	HI 2031B, FC 200B
5. Cheese	FC 200B
6. Dairy products	FC 100B
7. Dirty water	HI 1230B
8. Emulsions	HI 1053B
9. Environment	HI 1230B
10. Flasks	HI 1331B
11. Food industry general use	FC 911B, FC 100B
12. Fruit	FC 200B, FC 220B
13. Fruit juices, organic	FC 210B
14. Galvanizing waste solution	HI 1130B
15. Heavy-duty applications	HI 1135B
16. High purity water	HI 1053B
17. Horticulture	HI 1053B, FC 200B
18. Laboratory general use	HI 1131B, HI 1230B, HI 1332B, HI 1330B
19. Leather	HI 1413B
20. Lemon juice	FC 100B
21. Meat	FC 200B, HI 2031B
22. Micro plate sampling of less than 100 mL	HI1083B
23. Milk and Yogurt	FC 210B
24. Paints	HI 1053B
25. Paper	HI 1413B
26. Photographic chemicals	HI 1230B
27. Quality control	HI 1332B
28. Sausages	FC 200B, HI 2031B
29. Semisolid products	HI 2031B
30. Skin	HI 1413B
31. Soil samples	HI 1230B
32. Solvents	HI 1043B
33. Strong acid	HI 1043B
34. Submersion application	HI 1130B
35. Surface measurements	HI 1413B
36. Swimming pool	H I1130B, HI 2114P/2
37. Titrations with constant temperature range	HI 1131B
38. Titrations with wide temperature range	HI 1131B
39. Very high humidity	FC 911B
40. Vials and test tube	HI 1330B
41. Wine processing	FC 220B

** All electrode listed are supplied with 1m (3") cable and BNC connector.*

WARRANTY

All Hanna Instruments **meters are guaranteed for two years** *against defects in workmanship and materials when used for their intended purpose and maintained according to instructions.* **The electrodes and the probes are guaranteed for a period of six months.** *This warranty is limited to repair or replacement free of charge.*

Damage due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization number from the Customer Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

CE DECLARATION OF CONFORMITY

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Srl
V.le delle industrie 12
35010 Ronchi di Villafranca (PD)
ITALY

herewith certify that the waterproof pH meters

HI 9023C HI 9023CN HI 9024C HI 9025C
HI 9110 HI 9210 HI 9210N

have been tested and found to be in compliance with the following regulations:

IEC 801-2	Electrostatic Discharge
IEC 801-3	RF Radiated
EN 55022	Radiated, Class B

Date of Issue: 18-03-1996

D.Volpato - Engineering Manager
On behalf of
Hanna Instruments S.r.l.

Recommendations for Users

Before using these products, make sure that they are entirely suitable for the environment in which they are used.

Operation of these instruments in residential area could cause unacceptable interference to radio and TV equipment, requiring the operator to take all necessary steps to correct interference.

The glass bulb at the end of the electrode is sensitive to electrostatic discharges. Avoid touching this glass bulb at all times.

During calibration of instruments, ESD wrist straps should be worn to avoid possible damage to the electrode by electrostatic discharge.

To maintain the EMC performance of equipment, the recommended cables noted in the user's manual must be used.

In particular cases the instruments could turn off. In such cases, turn them on by pressing the ON/OFF key.

Any variation introduced by the user to the supplied equipment may degrade the instruments' EMC performance.

To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24VAC or 60VDC.

To avoid damage or burns, do not perform any measurement in microwave ovens.

HANNA LITERATURE

Hanna publishes a wide range of catalogs and handbooks for an equally wide range of applications.
The reference literature currently covers areas such as:

- Water Treatment
- Process
- Swimming Pools
- Agriculture
- Food
- Laboratory
- Thermometry

and many others. New reference material is constantly being added to the library.

For these and other catalogs, handbooks and leaflets, contact your dealer or the Hanna Customer Service Center nearest to you. To find the Hanna Office in your vicinity, check our home page at www.hannainst.com.

MANPHWPR3
02/00

HANNA instruments

http://www.hannainst.com